1 Approach

We present a novel approach to PoW difficulty scaling. We measure average time between requests and scale problem difficulty individually. Our model:

```
105 func rp_scale_model(p Param) Difficulty {
106         if math.Max(p.Cpu.Load, p.Cpu.Avg) < cpu_thres {
107                 return ZeroDifficulty
108         }
109         if p.Local.LongMean > 2*max(p.Global.ShortMean, p.Global.LongMean) {
110                 if p.Local.ShortMean > 3*p.Global.ShortMean
111                         && math.Max(p.Cpu.Load, p.Cpu.Avg) < cpu_thres+20 {
112                         return ZeroDifficulty
113                 }
114
115                 return BaseDifficulty
116         }
117         diff := *BaseDifficulty.multiply(1 + int((math.Max(p.Cpu.Avg, cpu_thres) - cpu_thres)))
118         return diff.multiply(1 + int(5*max(0, (p.Global.LongMean)/(p.Local.LongMean+1))))
119 }
```

Is compared to cpu_scaling:

```
120
121 func cpu_equal(p Param) Difficulty {
122         if p.Cpu.Avg < cpu_thres-30 {
123                 return ZeroDifficulty
124         }
125         return *BaseDifficulty.multiply(1 + 4*int((math.Max(p.Cpu.Avg, cpu_thres)-cpu_thres)))
126 }
```

2 Results

Table 0.1. No protection

Prot. model	Attackers			Legitimate users		Mobile devices	
	Pop. size	Solving	Service	Solving	Service	Solving	Service
None	120x7	0.57±0.02	19861.19±375.23	0.48±0.05	19965.45±1286.18	16.87±7.64	20800.60±3202.62

Table 0.2. Results from Server Flooding

Prot. model	Attackers			Legitimate users		Mobile devices	
	Pop. size	Solving	Service	Solving	Service	Solving	Service
PoW	17x4	1266±9	1794±12	3129±98	3652±99	31959±4576	32488±4556
RB-PoW	17x4	1875±43	2312±43	267±13	582±22	2975±1031	3469±1103

2.1 Mitigation against Server Draining

Table 0.3. Results from Server Draining

Prot. model		Attackers		Legitimate users		Mobile devices	
	Pop. size	Solving	Service	Solving	Service	Solving	Service
PoW	12x40	12700±199	14377±210	2616±119	3707±145	59119±14150	61005±14175
RB-PoW	12x40	14615±380	15371±383	4555±332	5206±345	29940±13426	30753±13490